**Name** **Date**

HANDS-ON LAB

# Mass and Weight

When you stand on a scale, most scales do not actually measure your weight. Instead these devices measure the force with which the scale itself is pushing up on you. However, when you stand on a scale you are not accelerating and so the upward force of the scale is equal to the downward force of gravity, which is your weight.

### MATERIALS

- hook (of a known mass)
- mass set
- ring stand and clamp (optional)
- spring scale, newton

If you were to travel to the moon, your weight would be different. Since the moon's gravitational force on you is less, the scale would need to push up on you with a smaller force. On the moon, you would find your weight to be about 1/6 what it is on Earth. However, your mass is the same on both Earth and the moon. Mass is the measure of the inertia that an object has. It is just as hard to accelerate and object on the moon as it is on Earth.

It seems that these two quantities—mass and weight—should be related in some way. But are they? And if they are, what is the relationship that exists between them?

**RESEARCH QUESTION** Is there a relationship between mass and weight. If so, how could you mathematically model that relationship?

## MAKE A CLAIM

Do more massive objects weigh more? If not, why not? If so, then what is the relationship between an object's mass and its weight?

## SAFETY INFORMATION

- Wear safety goggles during the setup, hands-on, and takedown segments of the activity.
- Falling masses can cause injuries; hold or secure the spring scale above an open space.
- Wash your hands with soap and water immediately after completing this activity.

## CARRY OUT THE INVESTIGATION

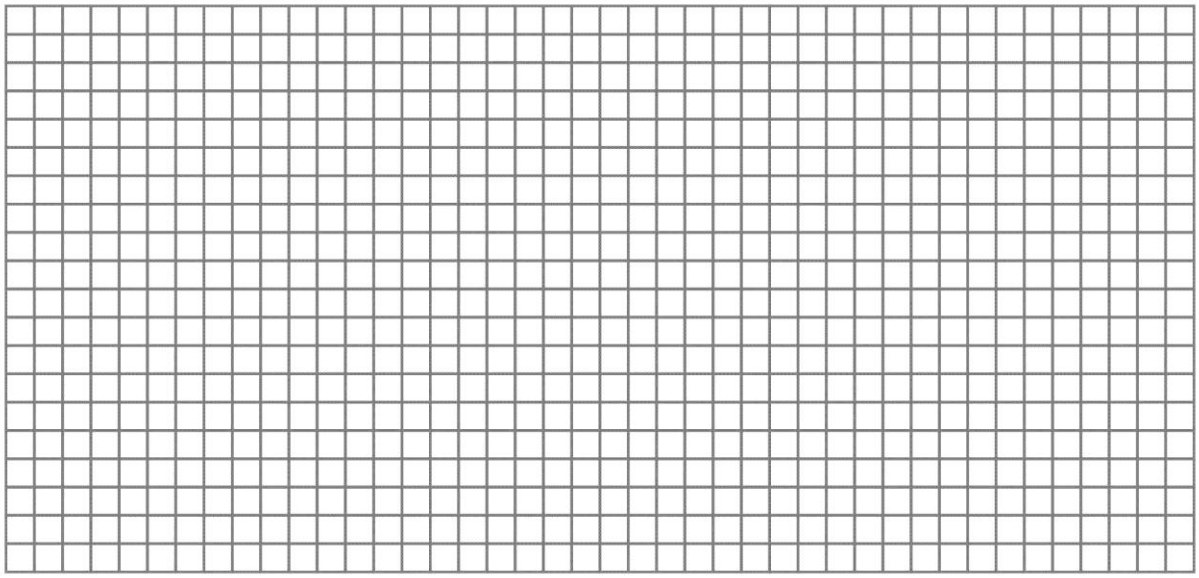
You have access to several different mass as well as a spring scale that measures force in newtons. In your Evidence Notebook, write out the procedure that you will use to investigation your research question. Describe your setup, how many trials you believe are necessary to accurately answer this question, and discuss any safety precautions that you will take. Use sketches to clarify your explanation of your procedure. Get your procedure approved by your teacher.

## COLLECT DATA

In your Evidence Notebook, make a table and collect your data. Be sure to label columns the columns of your table. Identify which factors are the independent and dependent variables.

## CALCULATE

Graph the data that you collected in your table. Be sure to put the independent variable on the *x*-axis.



## ANALYZE

1. **Use Computational Thinking** Use your table and graph to determine the relationship between mass and weight. Explain how you arrived at your answer.

2. **Identify Patterns** Write a mathematical equation that links weight (or $F_g$) and mass. Make sure to define any variables you include. If your equation includes any constants, make sure to determine the proper units for the constants.

3. **Test Predictions** Use your equation to predict the weight of a mass that you have not weighed yet. Then, weigh the mass and compare the result to your prediction.

## DRAW CONCLUSIONS

Write a conclusion that addresses each of the points below.

**Claim** Do more massive object 'weigh' more? If not, why not? If so, then is there a way to predict the weight of any object given just its mass?

**Evidence** Use evidence collected by your lab team, and other teams in your class, to support your claim.

**Reasoning** Explain how the evidence you gave supports your claim. Describe, in detail, the connections between the evidence you cited and the argument you are making.

## EXTEND

If you were to travel to the moon to perform this same experiment, what do you suppose would be different? How does this explain why even though the mass of an object on the moon would be the same as it is on Earth, its weight would be about 1/6 the value it is on Earth?